Name:_____ **Student Number:**_____

1) a) The PNP transistor of Figure 1 has a $\beta = 100$, $V_{EB} = 0.7$ V and an $I_{CBO} = 10$ nA.
Find the quiescent I_B, I_C, and V_{CE}.

I_B = _____ I_C = _____ V_{CE} = _____

b) Sketch the T and π transistor ac models for this circuit.
(Remember to label all components)

T π

c) What is the input impedance, Zin, output impedance, Zout, and the voltage gain, Av of this transistor amplifier?

Zin = _____ Zout = _____ A_V = _____

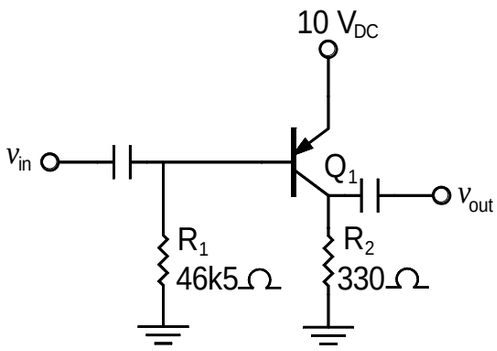


Figure 1

Name:_____ **Student Number:**_____

Name:_____ **Student Number:**_____

2) The transistor in Figure 2 has a $\beta = 100$, $V_{BE} = 0.7$ V, and an $I_{CBO} = 10$ nA.
The Schottky diode has a forward voltage drop of 0.4 V.

a) Find the currents I_B, I_C, and I_D.

I_B = _____ I_C = _____ I_D = _____

b) Is the transistor active, saturated or in cutoff?

Active ☐ Saturated ☐ Cutoff ☐

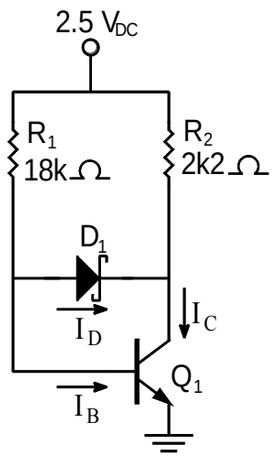


Figure 2

Name:_____ **Student Number:**_____

Name:_____ **Student Number:**_____

3) The transistors in Figure 3 both have a $\beta = 100$, $V_{BE} = 0.7$ V, and an $I_{CBO} = 10$ nA.

a) Determine v_{out} and v_e with $v_{in} = 0$ V.

v_{out} = _____ v_e = _____

b) What level does v_{in} have to be to just switch Q_1 ON?
In this condition, what state is Q_2 and the resulting v_{out}?

v_{in} = _____ Q_2 State = _____ v_{out} = _____

c) Starting with the condition of part b, what level does v_{in} need to be to just switch Q_1 OFF?

v_{in} = _____

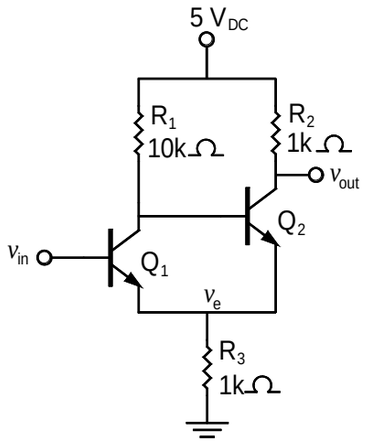


Figure 3

Name:_____ **Student Number:**_____

Name:_____ **Student Number:**_____

4) a) For the two stage amplifier shown in Figure 4, calculate the input impedance, Zin, output impedance, Zout, and the overall voltage gain $A_{V(Total)}$.

Assume $\beta = 100$, $|V_{BE}| = 0.7V$, $V_{CE(sat)} = 0.3$ V, $I_{CBO} = 0$, and that the amplifiers are biased properly.

Zin = _____ Zout = _____ $A_{V(Total)}$ = _____

b) Consider the situation where a generator with a source resistance of 990 Ω was connected to the input and an external 10 kΩ load was connected to the output.

What would the output voltage be in volts peak to peak if the generator was set for a level of 10 mV_{RMS}?

v_{out} = _____ V_{P-P}

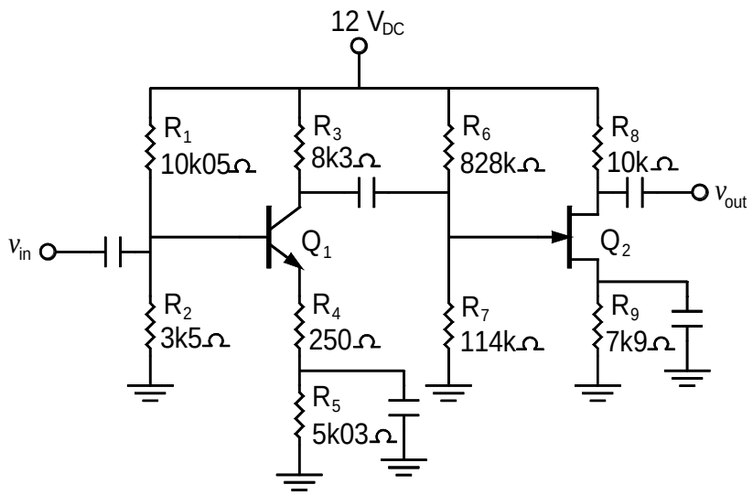
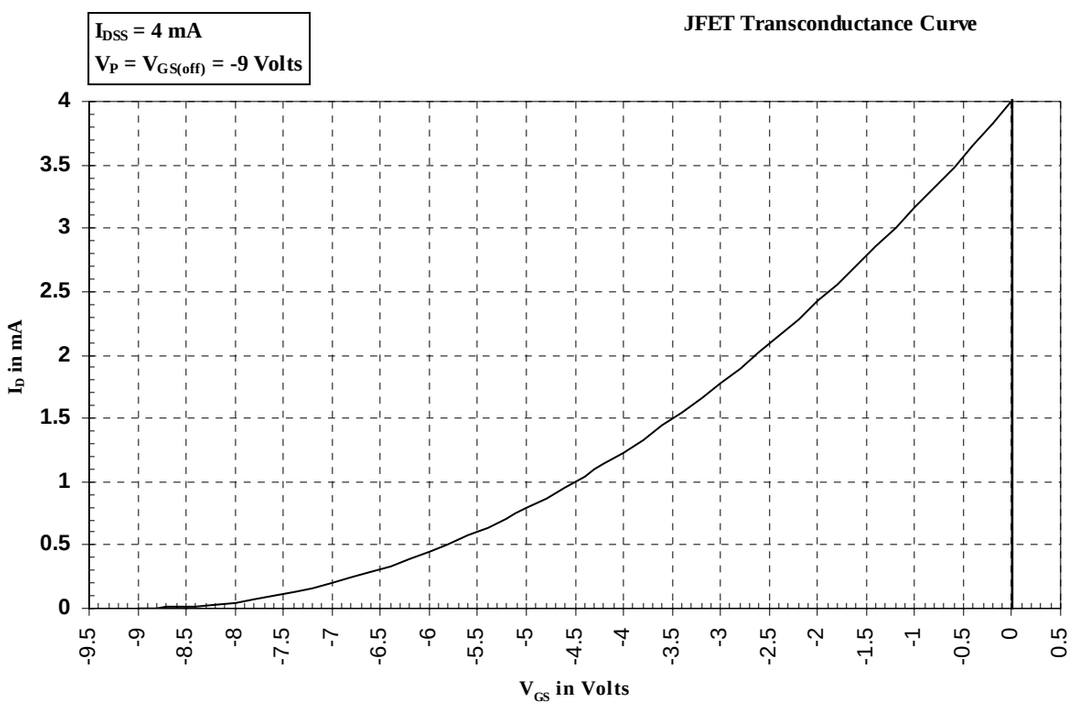


Figure 4



Name:_____ **Student Number:**_____

Name:_____ **Student Number:**_____

5) For the circuit shown in Figure 5, calculate the voltage v_o and the current i_o with a source voltage, v_s, of 3 V.

Note: Assume an ideal operational amplifier.

$v_o =$ _____ $i_o =$ _____

What direction is the output current, i_o, flowing?
(Note: Your calculations should support your answer. i.e. No guessing is allowed)

Into Op-amp ☐ Out of Op-amp ☐

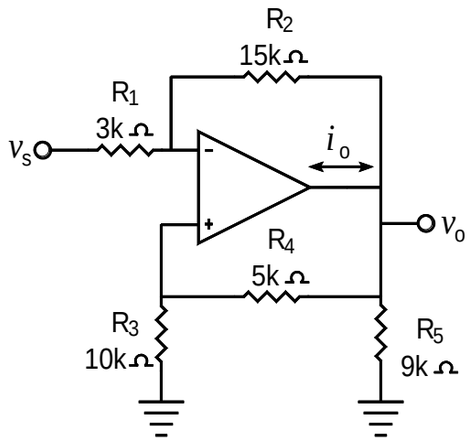


Figure 5

Name:_____ **Student Number:**_____